California GARDEN

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JAN 19

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Tuesday — 10:00 a.m. to 3:00 p.m. — Information: Mrs. Hoyt 296-2757

JAN 20

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Program: *Flower Gardens of British Columbia and Alaska*
with Mrs. Dorothy McFadden Bruegger
Casa del Prado, Majorca Room, Balboa Park, San Diego
Wednesday — 7:30 p.m.

FEB 2, 16

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Casa del Prado, Majorca Room, Balboa Park, San Diego
Tuesdays — 10:00 a.m. to 3:00 p.m. — Information: Mrs. Hoyt 296-2757

FEB 5, 12, 19, 26

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MAR 9

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FLOWER SHOWS

JAN 16, 17

SAN DIEGO CAMELLIA SOCIETY MINI SHOW
Casa del Prado, Majorca Room, Balboa Park, San Diego
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JAN 16, 17

SAN DIEGO ROSE SOCIETY ROSE PRUNING DEMONSTRATION
Parker Rose Garden, Balboa Park, San Diego
Sat: 10:00 a.m. to 2:30 p.m. Sun: 10:00 a.m. to 2:00 p.m. Free

FEB 6, 7

SAN DIEGO CAMELLIA SOCIETY 35TH ANNUAL SPRING SHOW
Casa del Prado, Majorca Room, Balboa Park, San Diego
Sat: 1:00 to 5:00 p.m. Sun: 10:00 a.m. to 5:00 p.m. Free

FEB 27, 28

SAN DIEGO ORCHID SOCIETY SPRING MINI SHOW
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VOLUME 73 NUMBER 1

Front Cover: Little Girl with rhubarb leaf umbrella, a whimsical drawing by Pat Maley. Mrs. Maley is a San Diego free lance writer and artist.

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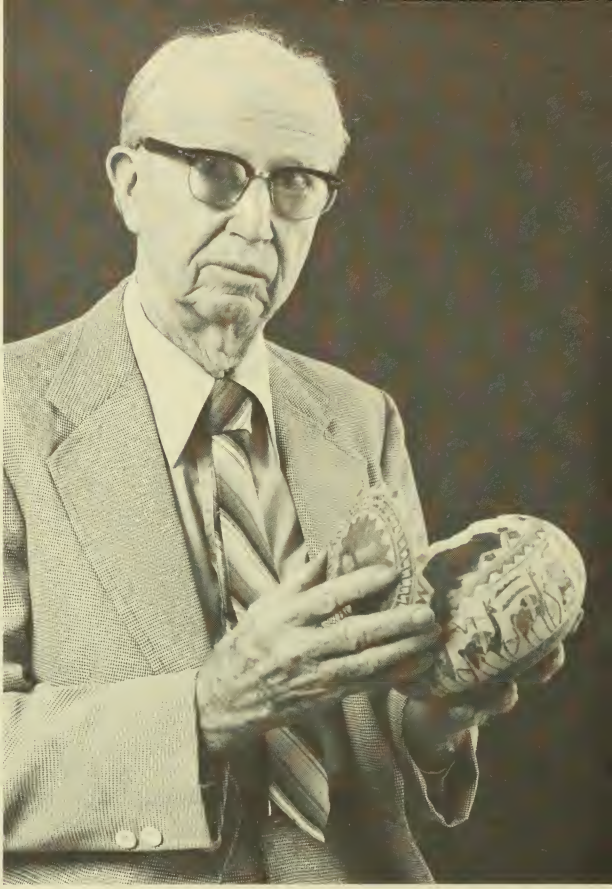
BOTANIST — A PROFILE

by *Sharon Siegan*



NEW YORK BOTANICAL GARDEN PHOTO

DR. THOMAS W. WHITAKER

IN THE SPRING of 1981 Dr. Thomas W. Whitaker capped a long, eminent career as geneticist and plant breeder with the earning of two special honors: he was named 1980 "Distinguished Economic Botanist," and Volume 3 of *Horticultural Reviews* was dedicated to him.

Now a La Jollan, Whitaker is a native Californian. He was born in Monrovia, California, (near Los Angeles) in 1905. His undergraduate studies were completed at University of California, Davis. His PhD was received from the University of Virginia where he was a DuPont Fellow. Following this he remained in academia for several years, teaching, lecturing, and serving a fellowship at Harvard's Arnold Arboretum. Then in 1936 he made a fateful decision; he joined the United States Department of Agriculture (USDA) and so began a relationship that endures even today, years after his official retirement.

Whitaker rose through the research ranks at USDA, winning the titles of principal research geneticist and investigation leader. His major interest and success have been focused on the development of improved varieties of produce, notably carrots, lettuce, and melons. Over the years he has developed disease resistant cultivars of lettuce and muskmelons, and written extensively on the ethnobotany of cucurbits—the gourd family whose melons and squash are so well known to us. Whitaker continues to collect cucurbits from central Mexico, their distribution center, recently searching out those wild species resistant to powdery

mildew and mosaic virus. When crossed with our domestic cultivars they will produce superior hybrids. It is such breeding experiments that have dramatically improved our commercial crops, benefiting the home gardener as well as the supermarket shopper. And it is such work that has earned him the esteem of his fellow botanists, for, as the dedication in *Horticultural Reviews* notes, "No one knows more about lettuce or cucurbits than he does."

In the course of gourd collecting, Whitaker has traced its history of use as a dietary staple for the Indian populations and as a container. Likewise he has noted changes in the cucurbits themselves, brought on over the years through the operation of natural selection, mutation, and self-fertilization.

Invitations to speak on the international circuit have afforded Whitaker an opportunity to indulge his special interests in many plants. Thus, after delivering a series of lectures in 1980 sponsored by the Argentina Commission of Scientific Investigations, he sojourned through the interior of that country, collecting his cucurbits at local markets,and amaryllis of rare or unusual beauty from private gardens and public places. Whitaker's interest in amaryllis is keen and he is recognized as a foremost authority.

Whitaker's comments on Russian agriculture are also noteworthy. Based on a visit in 1979 as a member of the People to People agricultural delegation, he views Russia's future dimly, predicting that "over the long run they cannot raise enough food and fiber to meet the rising demands of their people for improved living standards."

Dr. Whitaker's accomplishments are legion and they are detailed at length in *Who's Who in America*. He has been much honored by professional societies and has written for and been editor of many scholarly journals. Fortunately, he also has retained the ability to communicate with the general public, as witness his popular writings: "Lettuce: Evolution of a Weedy Cinderella," "Gourds and Gardeners," and "Gourds and People."

For his contributions to the world of Horticulture, we salute Dr. Thomas W. Whitaker and echo the words written by the editor of *Horticultural Reviews*:

> **"How wonderful you must feel to look over a life rich in accomplishments, and yet still exciting with expectations."**

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ALL ABOUT PUMPKINS, SQUASHES AND GOURDS

by *Thomas W. Whitaker* —illustrations by the author—

A GOOD WAY to commence a discussion of pumpkins, squashes and gourds is to define these terms in a meaningful way, if possible.

CONTRAST IN FRUIT SIZE AMONG SPECIES OF CUCURBITS
Left: Two fruits of the wild muskmelon (*Cucumis melo*)
Right: Giant fruit of the white-flowered gourd (*Lagenaria siceraria*)

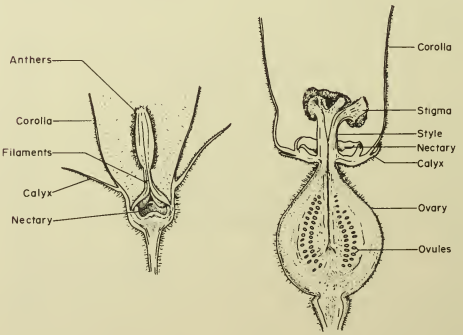
• Gourds are dessicated fruits with durable rinds such as the white-flowered gourds or bottle gourds, *Lagenaria siceraria*, and the yellow-flowered or ornamental gourds, *Cucurbita pepo*. Flowers of the white-flowered or bottle gourds open at dusk and are pollinated by night-flying moths, while orange or yellow-flowered gourds are pollinated by the so-called solitary bees or domestic honey bees. The spiny, sticky pollen of cucurbits is not windborne and requires transportation of the pollen from the male or staminate flowers to the female or pistillate flowers to set fruits. Sex expression in these plants is monoecious, that is, each individual plant bears two kinds of flowers, staminate and pistillate.

• Pumpkin and squash are lay terms, hence devoid of precise botanical meaning. PUMPKIN is usually defined as the edible fruit of any species of *Cucurbita*, utilized when ripe as forage, as a table vegetable, or in pies. The flesh is somewhat coarse, stringy and strongly flavored, therefore not generally served as a baked vegetable.

• The word SQUASH is derived from an Indian word indicating any fruit eaten raw and used immature. There are two kinds: SUMMER SQUASH–used immature as a table vegetable, and WINTER SQUASH–utilized when ripe as feed for livestock, as a table vegetable, or in pies. The flesh of winter squash is usually smooth textured, with mild flavor, suitable for baking.

FOOD VALUE

Squash is low in fat and calories except for the baking squashes which are reasonably high in calories. Squash contains other nutritional goodies in low or modest amounts, except they are relatively



DIAGRAMATIC ILLUSTRATION OF THE MONOECIOUS FLOWERS OF SQUASH
Left: Staminate Flower **Right: Pistillate Flower**

high in potassium. Also, the baking squashes are high in Vitamin A.

We can ask the question: Is there any good reason for eating squash? The answer is yes. They add a certain amount of zest and zip to monotonous diets. Furthermore, they are low in calories but reasonably nutritious, and can be eaten raw in salads, or fried, boiled, steamed, pickled, candied, dried and reconstituted, baked or made into pies or bread. If this list does not tickle your taste buds, the male flowers can be fried in batter and treated as fritters. This use of the flowers for food was probably invented by pre-historic Indian tribes in Mexico.

Another use of squash for food has recently experienced some popularity. A hard-shelled squash, a variety of *Cucurbita pepo*, is steamed in the oven; the flesh separates into long, firm, tender strands, and we have "Spaghetti Squash." It can be treated like spaghetti, but has much less effect on the waistline. Squash is so versatile in the kitchen that many cookbooks have been written about this vegetable.

Novelties now but possibly important in the future are the so-called "naked seeded" varieties. Seeds of this type do not have an outer shell, hence can be easily masticated. Fried in oil and salted they are a tasty, nutritious item comparable to peanuts as a food source. One of the best known varieties in this category is 'Lady Godiva'. The reason for this name is obvious. All naked seeded varieties belong to *C. pepo*.

There are at least two good reasons for the recent popularity of squash as a staple item in the home garden. First: they are easy to grow and are very productive. Two or three hills of summer squash can provide for the needs of a large family. Second: plant breeders have developed bush types of winter squash to replace the trailing types, thus space needs are greatly reduced, a crucial factor in the average home garden. Incidentally, squash is now ranked fifth most popular vegetable, behind tomatoes, beans, cucumbers, and lettuce.

Pumpkins, squashes and gourds are members of a large group of tropical vine crops known under the collective term "cucurbits." These vine crops belong to the plant family Cucurbitaceae. With pumpkins, squashes and gourds, cucurbits include such well known crops as watermelon, muskmelon, cantaloupe, casaba, honey dew, cucumber, gherkin, chayote, etc. Of more significance, fruits of vine crops are well known to laymen. Even a zoologist or molecular biologist who would be hard pressed to distinguish between a dandelion and a sequoia can easily recognize the fruits of squash, pumpkin, watermelon, cantaloupe, gourd, and others. Fruits of this group are among the most variable in the plant kingdom. They range in size from wild fruits of muskmelon or gourd that are no larger than a walnut to enormous giants weighing as much as 350 pounds—probably the largest fruits in the plant kingdom.

Vine crops or cucurbits are a remarkably homogeneous group; this means they are amazingly similar in form and functional traits. Even the diseases and pests that attack them are almost identical for the various species in the family. Likewise, the conditions required for their successful culture are similar. Moreover, all of them are intolerant of low temperatures; that is, the vines are killed by frost.

The biological problems my colleagues and I have uncovered in this group of plants are both fascinating and endless. I have spent nearly all of my professional career in an intensive study of the origin, domestication, culture, genetics, cytology, breeding systems, sex expression, and pollinators of these plants. Their economic importance, and their long association with man, particularly in the Americas, have made the cucurbits attractive subjects for research by numerous scientists in diverse disciplines.

We have proved from good evidence that man was cultivating squashes and gourds in the Americas as long as 10,000 years ago (8,000 B.C.). All of the early advanced civilizations in North and South America, such as the Aztec, the Inca, the Maya, and those that preceded them, were dependent upon the corn-bean-squash complex for their nutrition. Research studies indicate it is probable that man first domesticated squashes and pumpkins for their tasty seeds rather than the fruit flesh.

ARCHEOLOGICAL SEEDS FROM CHILCA, PERU (EXCAVATION IV-G6-A1; LEVEL 14: SCREENING); APPROXIMATE DATE 1100 A.D. THE SEEDS ARE THOSE OF A VARIETY OF SQUASH, *Cucurbita maxima*, SIMILAR TO THE MODERN SQUASH 'BANANA.'

ARCHEOLOGICAL PEDUNCLES OF SQUASH FROM CHILCA, PERU (EXCAVATION IV-G20-A1; LEVEL 16: COARSE SCREEN SAMPLE); APPROXIMATE DATE 1100 A.D.
Left: *Cucurbita maxima* **Center & Right:** *Cucurbita moschata*

The fruit rinds, fruit stems, and seeds of cultivated squash and gourds are nearly indestructible by fire and decay organisms, especially in a warm, dry climate. Thus, these fragments of squashes and gourds, evidence for the presence of man, have been preserved all over the Americas in caves, rock shelters, trash heaps, and kitchen middens wherever ancient civilizations flourished. They serve as biological artifacts for long extinct civilizations. For this reason, they can be used as a supplemental tool by archeologists, for identifying cultures, and tracing the migration of peoples. □

Editor's note: The MAR–APR 1982 issue will feature "How" to grow pumpkins, squashes and gourds–by Dr. Whitaker.

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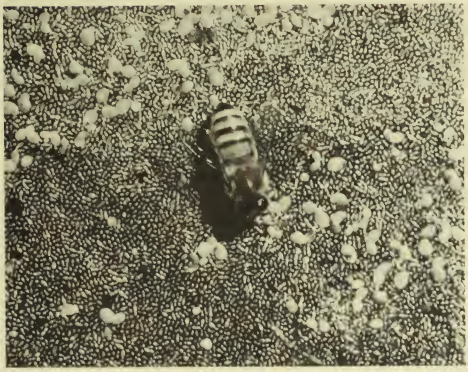

HONEYBEE RESTING ON A FLOATING CARPET OF WATER MEAL (*Wolffia*) LARGER PLANTS ARE DUCKWEED (*Lemna gibba*)

WE GARDENERS TEND TO GO FOR BIG SHOWY FLOWERS, ON PLANTS BIG ENOUGH TO SEE, OR TO COVER SOME GROUND. WE ARE PRESENTING HERE THE OTHER END OF THE SPECTRUM, PURELY FOR ITS MIND-BOGGLE VALUE. YOU ARE NOT URGED TO GROW IT—JUST TO MARVEL AT IT.

Miniature wildflowers can be found just about everywhere; they range from inconspicuous weeds in your garden to charming little belly flowers of arid deserts and rocky alpine summits. Although they are easily overlooked, the smallest blossoms are often very beautiful when viewed through a magnifying lens. The floral parts of minute floating aquatics of the duckweed family, Lemnaceae, are, in fact, so reduced that they are barely recognizable without magnification. Photographing minute flowers is challenging and rewarding, especially when you capture the intricate detail and coloration of seldom-seen plants.

DUCKWEED (*Lemna gibba*) IN FULL BLOOM TWO STAMENS AND A PISTIL EMERGE FROM A TINY REPRODUCTIVE POUCH NEAR THE EDGE OF THE FROND THE STAMENS AND PISTIL REPRESENT SEPARATE MALE AND FEMALE FLOWERS

One of the biggest problems in photographing minute flowers up close is the limited depth of field. Sometimes only a small portion of the flower can be in focus at one time. Maximum depth of field requires a very small aperture (high *f*-stop), a slow shutter speed, and a tripod to support the camera. Wind or other vibrations can be extremely frustrating and demand the utmost in patience. If it is possible, I

the air.

For several years the *Guinness Book of World Records* (including the 1980 edition) has insisted on listing artillery plant, *Pilea microphylla* as the world's smallest flowering plant. *Pilea microphylla*, is sometimes grown in hanging baskets and has bright green foliage that superfically resembles a fern. The name artillery plant is derived from its unusual anthers which literally explode and fire pollen into the air. Granted the flowers are minute, but the plant may grow to over 30 centimeters and is hardly the world's smallest. After more than a year of correspondence with *Guinness Superlatives Limited* in England, they finally agreed to bestow the title of world's smallest flowering plant on wolffia. In fact, they are using my picture of *Wolffia punctata* next to the point of a sewing needle in the next printing! □

THE WORLD'S SMALLEST FLOWERING PLANT (AS FAR AS WE KNOW AT PRESENT) THAT IS NOT THE POINT OF A PENCIL BESIDE THE BLOBBY LITTLE PLANT—THAT IS THE POINT OF A SEWING NEEDLE!

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WHAT IS A FRUIT?

A fruit is the ripened ovary—the seed and whatever surrounds it. A fruit can be dry and hard as in sunflowers or wheat, or juicy and soft as in melons and oranges. In sunflowers and wheat we eat the seed; in melons and oranges we eat the surroundings.

A strawberry, technically, is not a fruit—its fruits are those little black specks on the outside of the "berry." It is called an "accessory fruit" but you do not really need to know this, just call it fruit and enjoy it.

H.V.C.

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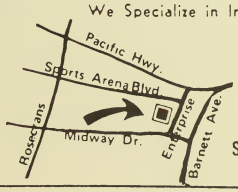

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WILDFLOWER SEASON—
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by *Helen Chamlee*

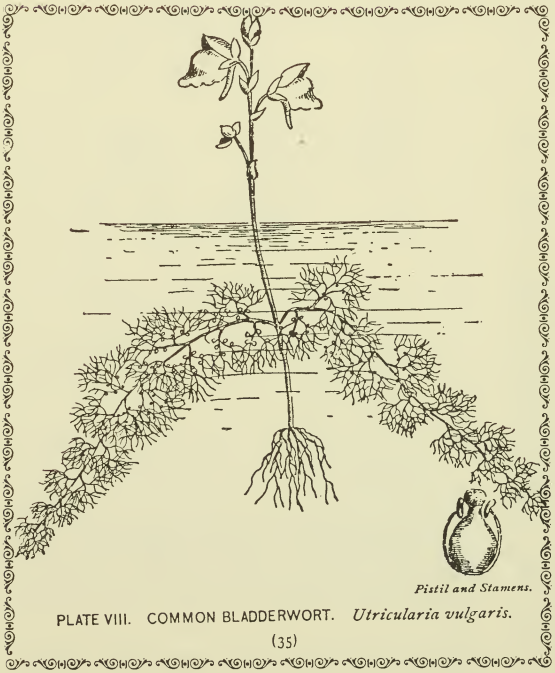


PLATE VIII. COMMON BLADDERWORT. *Utricularia vulgaris.*
(35)

THE AGE OF AN ILLUSTRATION DOES NOT MATTER. THE DRAWING LEFT, OF THE INTRIGUING AQUATIC PLANT BLADDERWORT, IS FROM *A Guide to the Wild Flowers* BY ALICE LOUNDSBURY, PUBLISHED IN 1899. A COMMON BLADDERWORT TODAY LOOKS JUST LIKE THE ONE DRAWN AWAY BACK THEN.

WHEN THE HEAVENS have done the right thing we can expect to see the first of the wild flowers by the end of February. Look for filaree, shooting stars, and the amaryllid called blue dicks, wild hyacinth or that lavender flower on a tall skinny stem. After you get acquainted you may call it *Dichelostemma pulchella* (Dye-kello-stemma pull-kella), which calls it beautiful in Greek.

Wildflower watchers need wildflower books. But how to choose?

Technical floras absolutely essential for the serious student, thick books such as Munz' "A Flora of Southern California," I mention and dismiss as not within the scope of this article.

Books for the layman are something else. This layman may be a traveler, a newcomer to an area, a lover of garden flowers who also likes the wild bunch. These people make up a growing crowd who want to know what it is they are enjoying.

What are some guidelines for choosing a wildflower book?

First, and this is critical, check whether it is a western book, if you live in that area. Those you find in park visitor centers and natural history museums usually are appropriate to the region, but look carefully at selections offered by the souvenir gift shop and the general book store. Many handsome wildflower books are produced in the east and their content is eastern.

Do not, unless you are homesick, buy one showing flowers that grow in Maine or Virginia, no matter how gorgeous. I took "Wildflowers of North Carolina" when I visited that state, but it would have been of little use in Oregon. If you are visiting a place only briefly and all the plants are new to you, by all means get one of the little "Fifty Common" or "Common Wildflowers of . . . " There in living color will be the flowers you are most likely to run across—the ones that are everywhere, and bright, and big enough to see.

There is the matter of color to consider. For a souvenir or gift book you may prefer a book all in color, but for learning to recognize the flowers you see out there you will do better with one that features line drawings. (Nowadays most of these include some color pages.) Even the best of color photographs cannot show the details of structure that distinguish one plant from another. In drawings such details are frequently enlarged, for example, a freshly opened flower and a mature seed structure. You may find also a tiny sketch of the whole plant, giving an indication of its size and habit. One set of books, published by Southwestern Monuments Association, sets a stick man or a foot ruler beside each sketch—a great help. If the plant towers above your head you know immediately it is not the one that barely reaches the 6-inch mark on the ruler.

You will find the plants in your guidebook arranged in scientific order. Now before you say, "I am not scientific and I don't care," please consider this: they have to be organized somehow, and this universally recognized order is simply a means of putting the Joneses all together instead of mixing them with the Smiths, and even the telephone book does that.

In flower books the plants with more or less grasslike leaves—the lilies, irises, onions and their like, will be grouped in one small section, usually at the front, though in some cases at the back. The broad-leaved plants will fill most of the book's pages; the sunflower family, largest of our wildflower families, is always the last in this section. The ones that look like garden asters or daisies or that pest the dandelion will be there; these closely related plants are all "sunflowers." You will soon get used to this customary order and be grateful for it.

In many guidebooks the plants are further categorized as to flower color. In such books you will

219. *Lupinus caudatus*
220. *Lupinus brevicaulis*
221.* *Lupinus Benthamii opimus*
222. *Lupinus horizontalis platypetalus*
223. *Lupinus concinnus*
224. *Lupinus rubens*

YOU MAY BE THINKING THAT LUPINES ALL LOOK THE SAME AND OF COURSE THEY DO HAVE RESEMBLANCES IN LEAF AND FLOWER SHAPE. SMALL DISTINCTIONS NEXT TO IMPOSSIBLE TO CATCH ON FILM CAN BE CLEARLY SHOWN IN DRAWINGS SUCH AS THESE. (JAEGER, *Desert Wild Flowers*)

find blue asters, white daisies, and yellow sunflowers in the appropriate color sections.

A second way of organizing the material, by habitat, works well in a mountain area where you may be able in a short while to explore a meadow, a forest floor, and a stream environment. Columbine and other shade- and moisture-loving plants are beside the stream, while out in the sunny meadow asters and big thistles are doing their thing, so you search the appropriate part of the book. Of course if you have a "shore wildflowers" all the plants are shore types, but there are differences between those of the dunes and of the adjacent grassy bluffs and the book may be sectioned accordingly.

You may run across wildflower guides in the form of keys. In a key you start with two statements, one of which fits the flower at hand. Choose that one

and go on to the next pair indicated, continuing thus until the word at the end of the line is the name of your flower. If you make a misstep somewhere along the line, it is back to square one for you. If you like puzzles you will enjoy and profit by the challenge of a plant key. If puzzles frustrate you, choose a different kind of book.

Now that you have your book, illustrated with drawings or photographs or some of each, how are you going to use it?

Well, first, TAKE IT WITH YOU, take it with you, take . . . . Now you and the book and the flowers are together, simply flipping pages has something to be said for it. It is a shortcut and it is fun. You bought the book in the first place because the pictures were so pretty, so go ahead and enjoy them. Oftener than you might think, such flipping will answer your question and it may also bring an unexpected bonus; when you are consciously searching for the picture of a flower having a certain color or shape, your subconscious will tune in with, "There's that flower I saw yesterday, it's a buttercup," and you will feel so smart!

Another shortcut is to match the flower you are looking at with a flower you already know; many wildflowers resemble garden flowers—delphinium for example. If you can come up with a name this way, look in the index, and check the entry on page 47. Your flower may be a delphinium, wild, and you will have added another acquaintance to your list. Other wildflowers have their garden counterparts—forget-me-not, Canterbury bell, lily, aster, violet—all of these received their English common names because they looked like plants that English settlers knew by those names in the old country. □

HAVE YOU EVER THOUGHT ABOUT IT?

What separates the plants from the animals? One of the easily observed differences is mobility—also growth pattern and nutrition.

• Mobility—most animals move about, but plants are anchored to the earth at the place where the seed germinated. (There are some plants that float, but none that actually swim) They just stand in one spot until they die.

Plants can be pushed around by wind, water, or animals, but they do not move in the same way animals do. They respond to outside stimuli such as light, heat, and gravity by growing toward or away from them, by wilting, shriveling, curling or folding leaves or flowers, explosively opening seed capsules, and in other ways. Plants exhibit movement also as they grow: stems elongate, tendrils curl, flowers open, leaves fall, but these movements are not the same as the jumping of a cricket or the coiling of a snake, since plants have no brain or nervous system to control their movements. Flowers never sneeze or scratch their ears; they do not fly, or dance in the wind—the wind shakes them.

• Growth Pattern—animals have a definite shape and most of them are genetically programmed to reach a certain size and then stop growing, while all plants keep on growing as long as they live. A redwood tree or an oak will keep growing larger for hundreds of years, but an elephant will not grow beyond a certain size even though it may live 75 years.

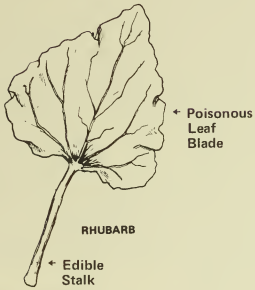
Barring accident, a cow has four legs (limbs); so does every other cow. But how many limbs does an oak tree have? What of the other oaks? Few animals can reproduce limbs when one is lost but plants can do this, or they can go on living with one or many dead parts, which animals can not do. A daffodil will "die to the ground," that is, all its foliage does die and decay, but part of the stem lives on as a bulb, which can produce a new top. No cow's leg could ever do anything like that.

• Nutrition—plants are the most independent of living organisms; they make their own food within themselves, while animals have to procure their food from outside sources. All the food in the world is produced by plants and algae (many of which are minute organisms in the sea which are the base of the marine food chain). Plants make enough food for their own growth and they store additional food in seeds, stems, tubers, and other parts. These are the wheat, watermelons, potatoes, sugar cane, apples, and so on that supply humans and other animals with food. H.V.C.

RHUBARB

by *Rosalie Garcia*

The Garden Pie Plant



RHUBARB IS A perennial plant that will grow in the garden along with the vegetables, but is used as a fruit. Explorers brought it to western Europe in the 16th century, and it came to New England with the colonists, where it was best known as pie plant because it was so often used baked between crusts as a fruit pie. Since rhubarb is a cold weather plant, first found in what is now eastern Russia, it might not be expected to flourish in our southern California subtropical climate, but it does.

Rhubarb, *Rheum rhaponticum*, is of the same family as dock and sorrel. The big red-veined leaves of the large plant spring from a crown which must be properly planted in a permanent location to bear the long juicy stems that are the edible part of the plant. The large leaves at the top of the stems must be cut off and discarded because they are so full of oxalic acid and salts that they are poisonous.

A friend who grew up on a river farm in Colorado tells me that her family had many plants along the river bank, an ideal location—rich soil, plenty of moisture, and cold weather. The children used to jerk off stalks in summer and carry them as umbrellas.

Growing rhubarb successfully depends on proper planting. Prepare holes at least 2 feet deep and 2 feet wide about 3 or 4 feet apart, preferably against a sunny wall or fence. Fill this hole over half full with good compost and manure, set in the rhizomes which should have several live buds and preferably some roots. Cover the rhizomes with about 4 or 5 inches more of the compost and tamp gently. Dampen this and keep damp, but not soggy. Three plants are ample for a family, as one plant can supply 10 to 20 stalks which may be all that one wants.

When buying rhizomes in early spring (they usually appear in our markets from January to March) look at them carefully. Test the buds for liveness and count them, and try to get roots. I suspect, but can not prove this, that some rhizomes sold are the spent ones from forced plants. I have bought several that did not develop.

The rhubarb we buy in our markets, the big pink stalks, are usually forced and come from commercial growers in colder regions. Forcing is done by lifting the rhizomes with as much soil as will hang on, putting them in boxes or tubs and filling the space around them with loose mulch or soil. These are

Drawing by Pat Maley

then covered with a blanket and placed in dark cellars or placed in greenhouses at a temperature of around 50°F. The stalks will develop in a few weeks, ready to harvest and send to our markets. Forcing does not give as high a yield as growing outside in the earth.

One may grow rhubarb from seed but it is a long uncertain process, left mostly to professional plantsmen interested in developing new varieties. These people are prepared with the patience and equipment for such ventures. In California we have varieties that have been developed for the region. The most common ones are 'MacDonald,' 'Victoria,' and 'Cherry Red.' We see them as the green stalk or the red stalk. Actually both are red (one dark red, the other bright red), but the dark red-green is the common one in our gardens.

Do not harvest any stalks the first year, let them develop and die down. The second year stalks will be bigger, more juicy and ready for the "jerk." One harvests the stalks by jerking them sideways from the rhizome. Remove the leaf (poisonous) blade from the top and discard it. Stalks will keep crisp for several days, longer when refrigerated, and are edible even when they are sort of limp.

Rhubarb is a food rich in minerals and vitamins and low in calories. Without sugar, a cupful is only 20 calories. Few like it straight because of its high acidity; a sweetener is added to make it palatable, this putting it into the dessert category. Sometimes it is served as a sauce with meat or chicken to add zest. Cut the stalk into short lengths, steam or cook in a small amount of water just to the boil stage. Because it cooks so quickly, one must be careful not to let it dissolve into mush. Sweeten to one's taste. If used for pies, put raw cubes in the lower pie crust with a little water, a sprinkling of tapioca and sugar, cover with top crust and bake like any fresh fruit pie. One can add nuts, raisins, and apples or it can be fancied into a custard pie with bananas and whipped cream for an exotic dessert. For a beautiful pink punch, cook until dissolved, strain, and add two measures of water to one of rhubarb. Sweeten to taste and mix with other juices. The tart flavor is tantalizing and appealing.

As with everything one grows or cooks, rhubarb must be experimented with and adapted to one's tastes, but it does lend itself to experimentation. Try it with strawberries as a sauce on morning toast—delicious! □

Unique Plants of Baja California

by *Dorothy Dunn*

BAJA CALIFORNIA, a land of contrasts, is a peninsula composed of mountainous regions covered with pine forests, tortuous rocky canyons of myriad colorations, spectacular stretches of seacoast unmarred by so much as a human footprint, tropical oases teeming with lush vegetation, and vast expanses of desert that many would call barren wasteland but which are actually rich in specialized forms of plant and animal life.

It is a place so unique that it supports many species of plants found nowhere else on earth, most notably cacti and other succulents. Of the more than 110 species of native cacti approximately 80 are limited to this area. One of the more remarkable features of this remarkable peninsula is the changes, sometimes to an amazing degree, in the overall aspect of the vegetation.

Over the past two and a half years I have been fortunate in making several trips in the company of those inveterate and knowledgeable Baja California explorers Russell and Bea Avery, into some of the peninsula's more remote wilderness areas. The interesting, uncommon, and attractive cacti and other succulents which abound in this area deserve greater attention and appreciation.

The first conspicuous succulent plant one usually encounters after crossing the border is *Agave shawii*, which grows in extensive colonies along the coastal bluffs and dry hillsides from Tijuana southwards. It grows in clusters of compact, symmetrical rosettes of dark green leaves. The flowers are greenish-yellow to orange, generally blooming from September to May. There are about 20 species of agave in Baja California. A close relative of *A. shawii* (and usually considered a variety) is *A. goldmaniana*, which occurs farther south, beginning below El Rosario. This agave has larger rosettes and does not cluster as prolifically.

A. shawii is soon joined by *Bergerocactus emoryi*, which forms dense thickets along the northwest seacoast bluffs and slopes, beginning almost at the border. *B. emoryi* has brilliant golden spines and blooms during April and May, creating an especially attractive and colorful scene when growing in combination with the deep green *A. shawii*. This is a genus of only one species.

About halfway between Tijuana and Ensenada, if travelling the old road, Ensenada Libre, the tourist is treated to one of the more breathtaking sights of any Baja California trip—sheer purplish cliffs down which quantities of startling white *Dudleya brittonii* appear to cascade. These dudleyas can be seen right beside the road, as well as on all the cliffs and hillsides in the distance. *D. brittonii* has a rather limited distribution, occurring mostly in the La Misión area. There is also a green form which is far less common.

Well below Ensenada, in the Arroyo Seco area, *Myrtillocactus cochal* begins to appear in abundance. This is a stout-spined branching cactus that grows on hillsides and mesas beginning just south of Ensenada and continuing all the way to the Cape. It flowers all year long, usually at night. Its fruit is edible and delicious.

I usually think of succulent euphorbias as belonging almost exclusively to such regions as South Africa and Madagascar, but a few are native to Baja California. One is the familiar and widespread *Euphorbia misera*, living up to its name and looking perfectly miserable. Although *E. misera* occurs throughout much of the peninsula, it grows almost rampantly in areas where almost nothing else will grow—notably right along the coast. There it assumes weird, prostrate, bonsai-like forms. It is almost always leafless as it needs rainfall to bring out the leaves; however, in many places the plants are festooned instead with a strange, singularly attractive lichen which resembles a tillandsia. Other Baja California

LOOKING NORTH FROM RUINS OF THE MISSION AT CALAMAJUÉ, ESTABLISHED IN 1766 AND ABANDONED SEVEN MONTHS LATER BECAUSE OF BAD WATER. THIS VALLEY WAS THE JESUIT TRAIL TO THE GULF AND TO THE MISSION SANTA MARÍA, WHICH TOOK THE PLACE OF THE OTHER MISSION. NOTE ROCK ENCLOSURES IN THE FOREGROUND, AND POINTED MOUND WHICH ONCE WAS AN ADOBE WALL. (WM. E. MACKINTOSH PHOTO)

euphorbias include the not commonly known *E. tomentulosa* which we first encountered just north of Laguna Chapala Seca and did not recognize as a euphorbia until we broke a stem and discovered the milky sap, and *E. xanti*, found in the Desengaño area and in the Sierra San Borja. *E. xanti* forms a large shrub whose extremely thin cylindrical stems produce an unbelievable profusion of pink flowers.

Several spectacular ferocacti inhabit central Baja California. One is *Ferocactus gracilis*, an exceptionally attractive red-spined barrel with red flowers and yellow fruit, which occurs from about El Rosario southward to below Punta Prieta, where it intergrades with and is replaced by its variety *coloratus* and *F. peninsulae* var. *vizcainensis* in the northern Vizcaíno desert. *F. gracilis* was so named by Howard Gates because of its tall slender form; it is usually less than 1 foot in diameter, but may occasionally reach a height of 9 feet. It grows in particularly arid sections from silt flats near the beach to rocky slopes. *F. peninsulae* and its variety *vizcainensis* occur farther south in central Baja California, from Bahía de los Ángeles and the Sierra San Borja to the Cape Region. *F. acanthodes* var. *tortulospinus* occurs in the Laguna Chapala Seca area and has a very limited distribution; scattered specimens have also been found in the Calamajue Canyon area. This barrel is impossible to mistake because of its very long (up to 7 inches) and strangely-twisted lower central spine, to which the specific name refers. The plant body is always simple. The flowers and fruit are indistinguishable from those of *F. acanthodes*. *F. acanthodes* var. *rostii* is found much farther north, in the San Matías Pass area, along the road which connects Ensenada with San Felipe on the east coast. Superficially it resembles the golden barrel, *Echinocactus grusonii*, but the body is a peculiar dull green shade and the spines are dull gold. Another unmistakable and very

rare barrel is *E. rectispinus*, which occurs at sea level along Conception Bay but may be found as high as four to five thousand feet. The flowers are a brilliant clear yellow, and the extremely long central spines sometimes reach a length of 10 to 11 inches.

The genus *Cochemiea*, consisting of five species, is native only in Baja California. The plants usually grow in cespitose (stemless) clusters from a central root and have rather long spines and brilliant red tubular flowers. This elusive *C. setispina* is found on rocky arroyo slopes above Mission San Borja deep in central Baja California. It is the most attractive species in the genus and one of the most attractive cacti found in the peninsula, with a medium-green body, white spines, and scarlet flowers. *C. maritima* is a strictly coastal species found in the vincinity of Punta Prieta and Bahía de Santa Rosalillito, where it grows on rocky slopes in association with *Mammillaria dioica, M. brandegeei, M. blossfeldiana, M. dawsonii, Pachycormus discolor*, and others. *C. poselgeri* occurs much farther south and has an affinity for rocky cliffs and canyon walls or flat sedimentary locations. It has longer stems than the other cochemieas, and these tend to have a somewhat pendant habit, trailing over rocks and sides of cliffs. *C. pondii* is found almost exclusively on Cedros Island, whereas *C. halei* is found only on Magdalena Island.

Machaerocereus is a genus of only two species, both indigenous to Baja California, although *M. gummosus* has been found in Sonora, on the mainland. This species is first encountered just north of Ensenada and extends the full length and breadth of the peninsula all the way to the Cape. It has a sprawling growth habit and forms dense, impenetrable, menacing-looking thickets. There is a rare monstrose form of this plant in which the ribs spiral up the stem, barber-pole fashion. We were fortunate to find one specimen of this unusual form in August 1978, along the road to the Meling Ranch. *M. eruca*, the famed creeping devil of the Magdalena Plain, is found in scattered colonies growing in sandy soil. This weird cactus is a native of the seacoast, but follows sandy washes inland for perhaps 15 miles in spots. It resembles nothing so much as a huge caterpillar; the weight of the plant contributes to a prostrate growth habit, and as the growing tip advances along the ground the older part dies back. The nocturnal flowers of *Machaerocereus* last for one night only.

BETTY MACKINTOSH PHOTO

Bergerocactus emoryi—ONE OF LOS CORONADOS ISLANDS IN THE DISTANCE

Several distinctive succulents are fairly common in central Baja California. One is *Pedilanthus macrocarpus* (candelilla) which is quite prevalent from the latitude of Bahía de los Á́ngeles south to the tip of the peninsula. It is a member of the Euphorbiaceae, and the jointed gray-green stems contain a poisonous milky sap which supposedly yields a kind of rubber. It has unusual bright red flowers, reminiscent of small red birds perched on the stems, which appear semiannually, February to May and August to October. An interesting crested form of this plant is often found in the wild.

Pachycormus (one of the elephant trees) is a genus of one species, *P. discolor*, found only in Baja California. Next to the boojum tree, *Idria columnaris*, it is the most characteristic tree of Baja California, with gnarled, grotesque branches and swollen caudex. It occurs on the west coast, beginning as far north as Cataviña and extending southward where it grows mainly on rocky hillsides up to an altitude of about 1500 feet. On some lava hillsides it is the predominant tree. It belongs to the Anacardiaceae, or cashew family, which also includes the sumacs. It can be found not only in the hot dry central desert region where it assumes contorted bonsai-like forms due to the strong, salt-laden winds. The descriptive Mexican name *torote blanco*, meaning big white bull, refers to the swollen muscular-looking trunk and limbs which serve as moisture-storing areas for this tree.

Bursera also are called elephant trees, and several species are native to Baja California. *B. microphylla* grows on rocky hillsides and flats throughout most of the desert areas. The pinnate leaves are dark green, strongly aromatic and usually evergreen, except during periods of prolonged drought. The flowers are inconspicuous and creamy-white and appear in midsummer.

Ficus palmeri, another interesting tree with a somewhat swollen base, is usually found growing in incredibly exposed rocky canyons and on cliffs, from San Ignacio southward, although we found what we believe to be this species farther north in the Desengaño area. It generally appears only as scattered individuals and its outstanding feature is its dramatic white root system which literally flows down over rock faces and through crevices.

Idria columnaris, cirio or boojum tree, is without doubt the most distinctive and bizarre plant of all. It is also the tallest—at least one specimen over 76 feet in height has been recorded. It is a monotypic genus, closely related to the ocotillo, *Fouquieria splendens*, and a mature tree somewhat resembles a shaggy, upside-down parsnip. It grows in a bewildering variety of sizes and shapes, all of them unbelievable. It may bear several crops of leaves each year, depending upon the rains, and the new leaves usually appear within 72 hours of a rain. Many boojums were freshly in leaf during our most recent trip in November, 1979.

Yucca valida is the predominant plant of the Vizcaíno Desert. It somewhat resembles the Joshua tree, *Yucca brevifolia*, of our southwestern deserts. In the Vizcaíno Desert most of these plants lean slightly toward the east, due to the strong prevailing winds blowing off the Pacific Ocean during much of the year. It blooms during the rainy season (March to August); the flowers are creamy-white with an odor of dill. There are also several other species of yucca in Baja California.

Baja California imparts an indescribable, almost mystical feeling to most of those fortunate enough to visit its wilderness areas. I have been privileged, on more than one occasion, to experience the thought voiced by Joseph Wood Krutch: "From where I stood there was no visible evidence that the earth was inhabited." It is a place so uncivilized that it has achieved the ultimate in civilization; pure clean air, clear sparkling waters abounding in marine life, luxurious limitless space, and absolute peace, quiet, and serenity. The night skies offer an unparalleled celestial display. It is truly a naturalists' paradise. □

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DO OAKS NEED APPLES?

by *Reid Moran*

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drawing by Gail Culver

Do Oaks Need Apples?

EVERYONE KNOWS THAT great oaks (and scrub oaks) from little acorns grow—which is to say that the acorn is the fruit and seed of the oak. And almost everyone knows that an acorn is a nut in a cup. But have you ever seen an oak apple? On scrub oaks about San Diego, California, and in our mountains they stand out in fall, deep pink on the sunny side and small-apple size, like fruit but not at all like acorns. So if the acorn is the fruit of the oak, why do oaks need apples? In fact, do they need apples?

An oak apple is part of the oak, made by the oak: yet it is nothing the oak would make by itself, without prompting. Oaks both great and small by little wasps are prompted—little gall wasps. When gall wasp eggs hatch in an oak stem, the oak obligingly surrounds them with a gall—the oak apple—in which the young feed and grow to adults. With this freakish outgrowth, the oak thus gives free board and lodging to developing wasps.

But why? Why should the oak do this for virtual strangers? Is it naturally hospitable? Or is it perhaps coerced? But then, how could an oak be made to build a wasp nest? What waspish threats could an oak hear or would an oak heed? What influence could a wasp bring to bear? The answer seems to be chemical influence, but don't ask for full details. "How?" is an easy question with a hard answer, and such questions far outnumber biologists to study them. We do know that normal plant growth is controlled by chemical agents called growth hormones: it seems that wasps make abnormal-growth hormones, which somehow cause this complex abnormal growth. Thus the wasps chemically manipulate the oak, with great though mindless cunning. We may ask "How?"!

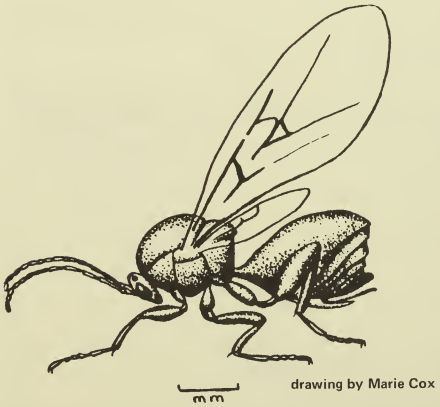
Gall wasps are not fierce and fearsome creatures, like more familiar wasps, but quite harmless, at least to us. Adults are short-lived and puny, commonly well under 4 mm (1/6 inch) long. They seldom fly and probably never travel far under their own power. They just live long enough and crawl far enough to find a mate, find a suitable place, and lay their eggs; in fact, some do not even mate before laying eggs.

Perhaps 2000 kinds of gall wasps are known, and hundreds more doubtless remain to be found. Though some kinds use other plants such as roses, most use oaks. Each causes a distinctive kind of gall, usually on one kind of oak, or a few related kinds, and on a particular part of the oak, whether roots, trunk, branches, buds, leaves, flowers, or fruit. California live oak has at least 86 kinds and scrub oak 55. The plant seems to form galls best in a part that is growing anyhow, and the eggs are laid in a part that is growing at that season. Galls are not all "apples" but are quite diverse in size and form, from woody to fleshy to woolly, depending mainly on the

kind of wasp and much less on the kind of plant. The kinds of galls are, in fact, much easier to recognize for most of us than the kinds of wasps; and even the entomologists find some wasp species almost indistinguishable.

Some galls clearly are deformities of ordinary plant organs: a swollen stem, a stem with crowded and enlarged leaves, a witch's broom, with crowded branchlets and leaves. It is easy to believe that such deformities might result from a little chemical interference with the hormones that control normal growth. And it is easy to see how the ability to cause such a gall could arise by natural selection if the insect happened to produce any substance affecting the growth of the plant in a way favorable to the insect.

Complex galls like oak apples are another matter: without prompting, the oak makes nothing like them. Often they cannot be explained even as a new deployment of kinds of cells and tissues ordinarily present. The normal oak has many kinds of cells; but gall cells may be quite different from any of them—often larger, with often larger and sometimes amoeboid nuclei, with multiple nuclei, or with multiple sets of chromosomes. Etc., which we need not go into.



drawing by Marie Cox

WASP (*Andricus californicus*) RESPONSIBLE FOR THE OAK APPLES ON THE SCRUB OAK; A FEMALE (NO MALES BEING KNOWN), ABOUT 1/6 INCH LONG

Some of the galls are quite elaborate, with several tissue layers that find no close parallel in the normal plant. Some galls regularly fall from the parent plant, and they may even continue to develop for a time after separation. In contrast to the deformed plant organs mentioned above, such a complex gall seems almost a separate organism.

The wasp thus brings out otherwise unsuspected potentialities of the oak, showing what an oak can do when pushed—or when the right buttons are pushed. For such complex departures from normal oak development, the chemical controls must also be complex; and considering the diversity of galls caused by related wasps on the same or closely related oaks, controls must be both varied and precise. Gallmaking is a triumph of ingenious physiological control, designed through the passive inventiveness of natural selection.

To learn what insect causes what gall, it is not always enough to watch and see who comes out: for the gall may house more than one insect. Food payoffs by the oak appeal to others besides the original extortionist; and many insects regularly live in someone else's gall. Even other gall wasps may move in, guest and host living side by side and emerging separately, to the confusion of careless gallwatchers. Guest and host, even when not closely related, may resemble each other remarkably and unaccountably. The guest gall wasp, even though not causing the gall to form, may chemically influence its growth and so make it different. Still other insects prey on the various gall dwellers. Each of the inhabitants, including the predators, may have its own insect parasites; and the parasites have their parasites and their predators. Some of these other inhabitants, though unable to make galls themselves, may also influence the form of the gall, even changing it beyond recognition. As many as 75 kinds of insects may live in one kind of gall, and many of them only there. So the gall may be a world in itself: some might call it a bughouse, but the polite word is "microcosm."

Some gall wasps have one generation per year, and some take two or three years to mature. Many have more females than males, and in some the eggs develop without fertilization, so that males seem superfluous. In fact, some have generations of lonely females, with apparently no males at all. Other gall wasps on oaks have alternate generations, often one in spring or summer, of males and females, the other in winter or spring, of females only. The two generations may be similar but often are so different as to have been named as different species, even in different genera. Likewise, the galls of the two generations may be similar but often are quite different; and being started at different seasons, they commonly are on different parts of the oak.

drawing by Gail Culver

SOME GALLS ARE DEFORMITIES OF ORDINARY PLANT ORGANS, LIKE THIS SWOLLEN STEM. NOTE HOLES WHERE ADULTS HAVE EMERGED

Even though life cycles and sex life of gall wasps may sound fascinating, who would expect a series of Kinsey reports? But Dr. Alfred C. Kinsey, later famous for other Kinsey reports, started as an entomologist and for many years studied and wrote of galls and gall wasps. Perhaps that's how he first heard about sex. That was before he thought up the technique of long interviews with his subjects, so instead he just watched. He studied life histories with gall wasps and little oak trees, in cages to keep the wasps in and everybody else, such as parasites, out. He would put in a gall just before the wasps were due to emerge, then watch the wasps lay their eggs on the oak and wait to see if a new gall formed. But it was not as easy as it sounds. Adult wasps, though living often several days, sometimes have so little vitality that they must lay their eggs in a few hours or they lose all interest. If the weather is wrong, they do not make it; and apparently everything else must be just right. The first year, before his little oak trees were well started, Dr. Kinsey got only 20 galls from some 2000 tries.

By seeing what wasps emerge from or still remain in the gall, gallwatchers have linked many galls with specific insects. But since long-term rearing is difficult, especially with those that live several years or have alternating generations, complete life histories are worked out for relatively few. Gall wasps too far outnumber gallists. About a third of the galls of our area are made by wasps not yet named or not identified with the named alternate generation. For many kinds only females have been found, and no one knows whether males ever appear. Nobody has even traced the wasp life cycle for our conspicuous scrub oak apple, shown above: females emerge in late winter; but is there an alternate generation? No one knows. As in many other branches of natural history, much is still to be learned from careful observations; and amateur gallwatchers could fill in many gaps.

Experts disagree on how to define a gall, but by any definition there are all intermediates from galls to non-galls. Various chemical agents applied to a plant will cause some injury or abnormal growth, which might perhaps be called a gall. Most gallists, however, think of a gall as an abnormal growth of a plant caused by some other organism, such as a gall wasp, not just incidentally but as a regular event in the life history of the wasp. The gall wasp is a parasite that has evolved this special means of manipulating the plant and always does so.

Though the most elaborate galls are those of gall wasps, plant galls are caused also by many gall midges, which are flies, by saw flies, which are primitive wasps, by some insects of other groups, such as aphids, moths, and beetles, and by some mites. Thus this way of exploiting plants has been invented several times. Somewhat similar deformities of plants are caused by certain roundworms, fungi, and bacteria. Though galls occur in all the lower groups of plants, the great majority are on flowering plants, especially dicots.

By now it is perhaps unnecessary to answer the original question of whether oaks need apples, but they do not. Whatever goes to make galls and feed wasps is of course lost to the oak; so in some measure the galls are a drain on the oak and harmful to it. Presumably, great oaks can afford the luxury of a little tax-deductible charity, to support a few needy gall wasps; and one or two oak apples would not break even a scrub oak. They are much less expensive than feeding a plague of locusts or caterpillars, for example. On the other hand, if the single stem of a small herb is distorted by a large gall, the life of the plant may be disrupted and the effect relatively large. And even an oak may be severely crippled by a heavy infestation of stem galls.

Some gall insects, attacking crop plants, may be serious economic pests. But some galls are useful to man. Some have been commercial sources of tannic acid and of dyes, and some are eaten by man and by domestic animals.

Though gallmakers harm the host at least to the extent of the food they use, some help the host in some other way. An example is the nitrogen-fixing

bacteria that live in root nodules (galls) of legumes and certain other plants. The bacteria build nitrogen from the air into organic compounds, some of which are used by the host plant. Every living thing needs nitrogen as a body component. Since the air is four-fifths nitrogen, there seems to be plenty for everybody; but nitrogen gas can be used only by nitrogen fixers—certain bacteria, blue-green algae, and the rest of us depend ultimately on them. Legumes, with nitrogen-fixing bacteria in their little nodules, have a built-in source; and that very likely is one reason the legumes are such a large and successful family.

I have rambled on so long since the origianl question that it seems only fair to include here a brief summary for those who, eager for an answer, have skipped over to the end. Do oaks need acorns? Yes. Do oaks need apples? No. It is gall wasps that need oak apples. Gall wasps are somewhat like people: while we act as if the world was made for our benefit, the sober truth is that nobody else really needs us. □

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WHY NOT GROW A CAMELLIA ?

by *Benjamin H. Berry*

Betty Mackintosh Photo

Mr. Berry, a retired naval officer, is a past president of the *San Diego Camellia Society*.

IT IS ONE of the most graceful and decorative of winter-blooming plants for southern California. Its flowers are breath-taking in their beauty, a beauty so widely recognized that even among the incomparable tuberous begonias the most beautiful species are singled out as being "camellia-flowered." The camellia is among the easiest of plants to grow; few things bother it, and no large space is required. Properly fed and watered, the camellia plant is handsome the year around with its dark green glossy foliage in summer and fall, and its gorgeous flowers in winter and spring.

Camellias currently on the market are limited to white, pink, and red, with some having a combination of two colors. Recently, however, we have acquired from China a yellow camellia. This gives promise of varying shades of yellow, peach, and apricot. Hybridizers are busy with this flower, and in four or five years we should be seeing their first products. You may recall that it was not until this century that a wild yellow rose was brought from Iran, and now we have roses in yellow, peach, and apricot.

With a little bit of care camellias can be grown in nearly any part of the country. Each winter we have a visitor from South Dakota at our mini show. Yes, she grows camellias in South Dakota without benefit of a hothouse. She tells me that when freezing weather arrives she takes her camellias to her bathroom where they get humidity, warmth, and light, and bloom beautifully for her. How lucky we are to live in southern California where camellias can be enjoyed the year around in the garden, on the patio, or on the balcony. This pleasure is shared also by residents of other western and southern states.

Life styles in these United States are changing. We who are fortunate enough to have individual

homes are a diminishing breed. Today the style of living focuses on apartments and condominiums with emphasis on the latter. Few have outdoor spaces though most do have balconies. Those who know the camellia utilize their balconies to raise a few plants. These must be protected from the hot midday and early afternoon sun but easily take the morning sun, provided they are not immediately next to a wall where they will get reflected heat.

Camellias like filtered shade—the shade of overhanging trees or manmade shade. I myself am fortunate in having room for a small shade house covered with saran cloth that furnishes filtered shade for my camellias. When they bloom I move them to our patio where we can enjoy their beauty.

It is fortunate that all camellias do not naturally bloom at the same time. Some are early bloomers—November to January. Others bloom at midseason—January to early March, and the late bloomers from late February to early April. I have a good-sized early bloomer, 'Alba Plena,' a white formal double. It starts blooming in mid-October, and this year we had blooms as late as early May. I must confess that these later blooms left much to be desired, but they provided interest!

Earlier, I mentioned that the camellia is a thing of beauty when properly fed and watered. Families that do not have room to put their camellias in the ground must resort to container-culture. A container-grown plant will require more water than a similar plant grown in the ground, and will require more frequent fertilization. First, about watering: if you have soft water in your indoor water taps, do NOT use it. Household water here in southern California is often softened by being filtered over salt, and too much salt will kill any plant. The Colorado River water we get here has more than enough salts and minerals without adding more. If your indoor water is soft, go to an outside spigot for water. Better yet, if you have a place to catch and store winter rain water for future use, by all means do so.

When watering a container-grown plant, apply enough water so it runs freely through the container. This will flush out any salt buildup. Keep the plant moist but not wet. Plants breathe through their leaves and their roots. Roots in soggy soil can not breathe and the plant will die. More plants have been drowned than killed by lack of water.

As to fertilizing, bear in mind that container plants do not have the soil mass of those growing in the ground. Consequently their fertilizer is leached out much faster. For camellias and other container plants one of the best fertilizers is fish emulsion. Once a month, from May to October, feed them at the rate recommended on the package.

As I said before, few things bother camellias, but occasionally aphids will attack new growth. Usually one application of any good garden spray will eliminate them. Sometimes during the later summer and winter months looper worms will eat holes in buds, though fortunately this is an isolated occurrence. Again, any good garden spray will take care of them. Among sprays, the two with the least residual effect are malathion and spectricide.

If you would like to acquire camellias or add to your collection, perhaps the easiest way to make choices is to visit a camellia show. The members will be happy to advise and assist you. San Diego's show is in February in Balboa Park and many other cities hold similar shows.

You must decide what color you would like, what size flower, what form of flower, and what size and form of bush you would like. Flowers vary in size from the miniature, less than 2½ inches in diameter, to the very large, more than 6 inches in diameter. Plants range in size and shape from trailing dwarfs to trees of considerable height. Some camellias flower up and down the stem while others limit their buds to the terminal growth area. Whichever way, the camellia will reward you with beauty.

Suggested whites:
- **Alba Plena — medium formal double**
- **Nuccio's Gem — medium formal double**
- **Cottontail — miniature full peony**

Suggested pinks:
- **Nuccio's Pearl — medium formal double**
- **Coral Delight — medium semi-double**
- **Kramer's Delight — large full peony**

Suggested reds:
- **Kramer's Supreme — large full peony**
- **Kramer's Beauty — medium full peony**
- **C. M. Hovey — medium formal double**

Camellias have something for everyone and every garden. □

NOW IS THE TIME

A cultural calendar of care from our affiliates—

compiled by **Penny Bunker**

BEGONIAS MARGARET LEE

Now is the time
- to watch the watering program—slow growth requires less water, but do not allow to dry out.
- to practice clean housekeeping—clear away old foliage and leaves.
- to start cutting back canes and shrub types.
- to add more planter mix to pots as needed to keep roots covered.
- to spray for mildew and check for pests.
- to start tuberous begonias in February for bloom later.

BONSAI DR. HERBERT MARKOWITZ

Now is the time
- to collect native stock in the California region—plant the native trees in a larger container, not a bonsai pot.
- to graft conifers.
- to use lime-sulphur spray on deciduous trees.
- to reduce watering if a rainy period.
- to prune fruit-bearing bonsai.
- to graft deciduous and evergreen trees.
- to start in February to repot and transplant some varieties if weather is favorable
- to withhold fertilizer to allow plants to rest.

BROMELIADS LINDA PRELL

Now is the time
- to give plants a rest—do not fertilize at this time.
- to withhold watering if weather is cold and rainy.
- to keep cups of plants dry for winter protection.
- to bait for slugs and snails that thrive during damp weather.
- to sit back and enjoy your garden.

CACTI & SUCCULENTS RICHARD LATIMER

Now is the time
- to protect frost-tender succulents such as, jungle cacti, melocacti, kalanchoes; and some aloes and euphorbias.
- to let the rains take care of plants in the ground and exposed pots.
- to watch pachypodiums—they may go dormant. If they drop their leaves, let them go dry until March. Otherwise, they may be watered.
- to collect rain water for use the rest of the year.
- to keep a watch for snails and slugs. Might search at night to check their activity.
- to discard aloes infested with aloe mites.
- to make sure rodents are not eating aloe leaves or carving out the interiors of agaves or the roots of the yuccas from underground tunnels.
- to pull weeds while they are small, green, and manageable—do not allow them to seed.
- to enjoy the blooming carpet of mesembs, aloes, and agaves, especially *Agave attenuata* or one with a giant asparagus in the middle. Keep track of how long a bloom stalk grows each day.

CAMELLIAS BENJAMIN BERRY

Now is the time
- to remove poor and old blossoms to prevent fungus buildup.
- to use a fungicide if needed.
- to plant or transplant, while in bud or bloom, before new growth starts.
- to check soil mulch and add either fir bark or pine needles at base of established plants.
- to select plants from nurseries while in bloom.
- to plant above the soil level, firming soil so they will not settle; mulch at baseline.
- to feed 2-10-10 or 0-10-10 fertilizer to established plants.

CALIFORNIA NATIVES HELEN CHAMLEE

Now is the time

- to plant and transplant natives while they can thrive on native rainfall.
- to check them after heavy rains, making sure that water does not stand around them or that mud does not build up above the native soil line on the main stem.
- to reorganize your garden, grouping the natives, Australians, and other drought-resistant plants together where you will give them less water than subtropicals.
- to sow seeds of wildflowers in prepared beds.
- to make plans for at least one trip to the desert; its flowers are virtually impossible to cultivate; enjoy them in their own home.
- to look for pussywillows, a guarantee that spring is on the way.

DAHLIAS ABE JANZEN

Now is the time

- to dig tubers left in the ground. By early January the tops should be completely withered. Cut tops just above the ground.
- to store tubers without dividing—use vermiculite or sand, leaving any soil that clings to them. Keep in a cool area.
- to inspect those tubers already stored earlier for signs of shriveling; if too dry, add a little moisture.
- to start in February to prepare the garden plot. Turn the soil, add humus,and fumigate. Dig in humus, equal parts of superphosphate and sulphate of potash—turning well. Add fertilizer two or three weeks before planting.

EPIPHYLLUMS (Orchid Cacti) FRANK GRANATOWSKI

Now is the time

- to feed mature plants with nitrogen-free or low-nitrogen fertilizer such as Bloom-Builder, Hi-Bloom, etc., to promote blooming this spring. Either liquid or time-release granules can be utilized. If liquid is used, a subsequent application is advisable in another month.
- to prune out unproductive and unsightly growth, thereby allowing more energy to be utilized by newer and healthier branches.
- to maintain preventive pest control by keeping plant containers free of debris and extraneous materials. Spray with insecticides only when necessary. Orthene, malathion, and cygon are available locally. Read and follow directions carefully!
- to protect from unexpected frost and strong wintry winds.
- to pick the ripe apples (seed pods). They may be planted immediately without undergoing drying process, however, some sort of natural or artificial light and heat is needed to encourage germination.
- to bait for snails and slugs. A few granules of Sluggetta has proved to be very effective and leaves little or no unsightly residue.

FERNS RAY SODOMKA

Now is the time

- to water gently, but do not soak as during the hot days. Cool nights keep their feet too cold. Beware of hot, dry winds. Do not rely on the rain to find your hidden and covered plants.
- to remove and remount platycerium pups.
- to keep after slugs, snails, and pill bugs. Winter does not stop them.
- to trim off dead fronds and keep surrounding areas clean. Use dead material for a compost—give it back to nature.
- to plant spore.
- to cover and protect plants during the night in frost areas. Cover them with newspaper, sheets, or plastic bags. Put them into the garage, if necessary.
- to relax fertilizing—use pellets instead of liquid, due to cold nights.

FUCHSIAS WILLIAM SELBY

Now is the time

- to clean up spent blossoms, fallen leaves, etc. All debris is a hiding and/or breeding place for insects, mold, fungus, or whatever.
- to use insecticides or fungicides only if you have a problem.
- to prune heavily, leaving strong stems about ½ inch ahead of a node. Remove weak, thin branches.
- to prune hanging plants back to edge of the basket—trim to within 4 inches of soil on top.
- to take cuttings from good end clippings—take a little longer to root in cool weather.
- to prune when the soil is moist and the leaves turgid (full of water).

GERANIUMS CAROL ROLLER

Now is the time

- to only water when plants have become fairly dry. Each watering should moisten the entire soil ball—excess water should escape through drainage holes.
- to continue feeding a balanced fertilizer dissolved in water. Use at half the recommended strength every fourth or fifth watering, or as often as needed to keep the plants growing well.
- to prune plants which have not been cut back. Leave some green leaves on each stem being cut back. Lanky plants can be brought under control by pruning again in 4 to 6 weeks.
- to make cuttings from the prunings. Shelter cuttings from extreme weather conditions.
- to tip-pinch plants which were pruned early in the fall.
- to continue pest and disease control using products according to manufacturer's directions.
- to give temporary shelter from freezing if temperatures go below 28° F.
- to rotate plants regularly for symmetrical shape.

GESNERIADS (African Violet is one of many) MIKE LUDWIG

Now is the time

- to prepare pots for the spring planting season—wash with hot water and let them stand overnight in clorox solution to kill unwanted pests. Wash thoroughly after soaking and let them air dry.
- to be sure not to water on a cold or cloudy day, or late in the afternoon.
- to spray for pests and disease as plants are somewhat dormant and less subject to damage. Check undersides of leaves and the crown of the plants.
- to send for catalogues for spring ordering; order supplies to have on hand when needed.
- to start achimenes rhizomes now. Place them on a damp bed of vermiculite in a shoebox; watch the new growth for mold. Should have signs of new growth in 15 days if the temperatures are warm enough. Plant them in loose mix, barely cover, water thoroughly and wait for the sprouts to show through the soil.

IRIS SAN DIEGO–IMPERIAL COUNTIES IRIS SOCIETY

Now is the time

- to continue water program, especially if rains are light.
- to start a regular spray program with copper oil spray to help control rust.
- to make last plantings of the bulbous iris for spring bloom.
- to start in February to feed all iris with 0-10-10 liquid fertilizer—follow directions carefully and do not over-fertilize.
- to establish a regular program of snail, slug, and aphid control.
- to keep old brown fans cut off tall-bearded; good ground cleaning and spraying is helpful in pest control.

ORCHIDS CHARLIE FOUQUETTE

Now is the time

- to always check the moisture in pots of phals and cattleyas.
- to check the position of the sun—there are days when it can still burn plants.
- to check name tags on plants and in pots. Be alert; do not lose identification.
- to use low-nitrogen fertilizer on cymbidiums. Do not feed if overcast.
- to stake up flower spikes on cymbidiums and place light-flowered plants in bud and flower in shade to prevent fading.
- to remember phals should be spiking; and if moving the plant, place it in same general direction and area so flower will bloom in a uniform manner.
- to remember that bud drop on phals and ascocentrum are often caused by change in air draught, temperatures, heaters, etc.
- to water early in the morning so crowns will be dry by nightfall.
- to protect your plants with a shelter; remember heavy rains and hail damage many plants.
- to be aware of any sudden temperature drops in outlying areas.

ROSES SAN DIEGO ROSE SOCIETY

Now is the time

- to prune roses—watch for dates of the demonstration on pruning in Balboa Park (San Diego, Calif.).
- to plant bareroot roses, mounding each bush with a damp mulch material until new growth starts,to prevent dehydration.
- to spray after pruning established plants to control pests, rust, fungus—use a dormant spray on bushes and all surrounding areas.
- to cultivate established roses as new growth starts—give a feeding using one cupful per bush.
- to give newly planted bushes a liquid fertilizer six weeks after planting.
- to start preventative spraying in February for mildew and aphids—use ½ strength on new foliage.
- to add iron chelates after roots start growing.
- to establish a regular watering and spraying schedule.

VEGETABLES GEORGE JAMES

Now is the time

- to start indoors, in flats or pots, seeds of tomatoes, peppers, squash, and cucumbers which will be grown on in pots to be planted in the garden about the middle of March.
- to plant roots of perennial vegetables and berry plants in the garden as rain and cold weather are not likely to harm them.
- to plant onion sets and make a second planting of lettuce and vegetables of the cabbage family, and celery—using started plants.
- to plant divisions of artichokes, roots of asparagus, and plants of fruiting berry vines as soon as possible—before the end of February.

GREEN THUMB HERMET KERMET

Now is the time

- to set out bareroot stock of deciduous fruit trees, shade trees, shrubs, and vines.
- to plant cool season annuals for spring bloom—African daisies, calendulas, pansies, Iceland poppies, snapdragons, stock, etc.
- to plant gladiolus at 15-day intervals for a long blooming season.
- to apply dormant sprays to deciduous plants, especially roses and fruit trees—kill eggs and larvae of harmful insects and some fungus spores.
- to prune out old branches on pyracanthas after berries are gone and shape as necessary.
- to cut back chrysanthemums to the ground.

Not to Eat or Play With

FRUIT OF THEVETIA THEVETIOIDES

Photos by LARRY PAULTER

Thevetia thevetioides

Thevetias (the-vee-shas) are tropical American trees or shrubs widely grown for their showy yellow or apricot flowers. Like their near relatives the oleanders they are high on the list of poisonous plants. The poisonous principle is concentrated in the fruit, especially in the kernels or seeds.

Children find the large smooth fruits attractive, either as "something to eat" or as playthings which, as we well know, frequently go into mouths. CALIFORNIA GARDEN recommends removing fruits from thevetia plants growing in areas where children might be tempted to experiment.

H.V.C.

Thevetia Seed Pod

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sometimes photograph specimens indoors using photoflood lamps or electronic flash. Photoflood lights allow you to clearly see what the illuminated subject and background will look like, but they produce so much heat that your flower withers away very rapidly! For extreme close-ups I have had good success using a Bausch & Lomb dissecting microscope with a camera adapter. With magnifications of 10 to 40 power, minute flowers only a few millimeters across will fill the entire negative or color transparency. If the light is carefully adjusted, enough depth of field can be produced to make a decent photograph. I prefer a high intensity beam from the side, and depending upon the subject, a fluorescent substage light source which gives the effect of back-lighting.

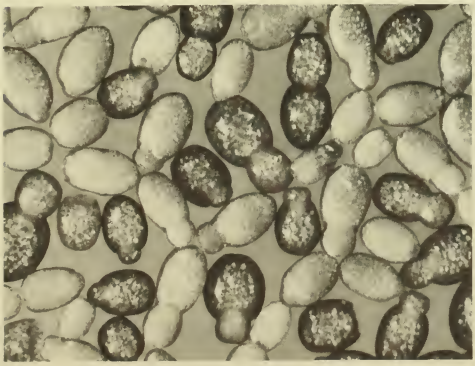
Size relationships, such as eyes and points of needles, straight pins, coins, and other familiar objects, probably distract from the subject; however, I find them very useful in color slides used for teaching. During one lecture on desert belly flowers a student asked me if the ground was littered with pennies where I took the photographs.

The world's smallest known flowering plant belongs to the genus *Wolffia*, in the duckweed family, Lemnaceae. Each plant is only one millimeter long, and consists of a globose or oval "frond" that floats at the surface of quiet streams and ponds. These plants have no roots, stems, or leaves, and look like green, mealy particles. In fact, an appropriate common name for the genus is water meal.

Wolffia punctata IN FULL BLOOM CENTER FROND HAS A CENTRAL CAVITY CONTAINING A CIRCULAR, CONCAVE STIGMA (APPEARING LIKE A TINY DONUT) AND A MINUTE ANTHER JUST ABOVE IT ACCORDING TO "A MONOGRAPH OF LEMNACEAE" BY E. H. DAUBS (1965), FLOWERING IN *Wolffia punctata* HAS NEVER BEEN REPORTED IMAGINE PICKING A BOUQUET OF *Wolffia* PLANTS FOR YOUR TABLE!

During the summer of 1980, I discovered two species of wolffia in the San Dieguito River, in San Diego County just below Lake Hodges Dam. In several ponds they were so numerous that the entire water surface was covered with a green film. After examining many thousands of wolffia plants during the past year, I finally found one in flower. A small opening develops on the dorsal (upper) surface of the frond. Inside the cavity below the opening are a single anther and a single pistil. According to several authorities, the stamen and pistil represent separate male and female flowers. This is the ultimate in reduction of a flower—a no frills sexual reproduction.

Photographing wolffia plants is a real challenge. Under a dissecting microscope the smallest vibration moves the plants like they are in a typhoon. Even small crustaceans such as copepods, ostracods, and water fleas can bump into the fronds and cause annoying movements. I have had my best success when they are packed "wall to wall" in a shallow Petri dish. One of my most frustrating projects was trying to photograph a wolffia next to the point of a sewing needle. The problem was positioning the wolffia and then keeping it in one place long enough to take the picture. They have to be photographed in water because wolffia plants dry and shrivel rapidly in



DENSE POPULATION OF WATER MEAL (*Wolffia*) FROM THE SAN DIEGUITO RIVER, SAN DIEGO COUNTY THE DARKER, MORE SPHERICAL FRONDS ARE *Wolffia columbiana* THE LIGHTER FRONDS WITH A FLAT-TOPPED, PITTED (PUNCTATE) SURFACE ARE *Wolffia punctata* SOME OF THE PLANTS ARE BUDDING (PRODUCING DAUGHTER FRONDS)